

1.65um Pulsed Laser for Space Based Winds, Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

Fibertek, Inc. will develop a single-frequency, Er:YAG laser transmitter to advance the technological readiness level (TRL) of a key technology component of the 3D wind measurements identified in the recent Earth science decadal survey "Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space". The Er:YAG development will advance the technology of a space-based wind lidar system by focusing on developing a compact, efficient diode pumped transmitter that is conductively cooled. Current efficient 2 μ m systems are pumped by fiber lasers to take advantage of the high brightness source, but this tends to increase the packaging footprint. To maintain long pulsewidths >100ns, the 2 μ m systems cavities are typically greater than 2 meters in length. By working at higher repetition rates (500Hz or above) than are typically targeted in 2 μ m systems, Fibertek will take advantage of the long storage time of Er:YAG to maintain efficient operation, while operating at longer pulse lengths in a shorter cavity (with respect to Ho:YLF systems of similar pulse lengths) due to the low gain of the Er:YAG. Fibertek's approach will be based on an Er:YAG resonator operating at 1645nm and resonantly pumped by high brightness semiconductor laser diodes.

This program will build on successful Er:YAG work at Fibertek focused on methane and water vapor lidars. These systems are 7-10W systems optimized for operation at higher repetition rates. The Phase I work will demonstrate a high power (>12.5W) oscillator optimized for 500Hz operation with a Technology Readiness Level 4 (TRL-4) for a coherent wind lidar. In Phase II we will develop a hardened brassboard version of the laser that would be suitable for airborne systems. We will also perform a trade study on how to achieve the highest damage threshold coatings at 1.6455 μ m.

Anticipated Benefits

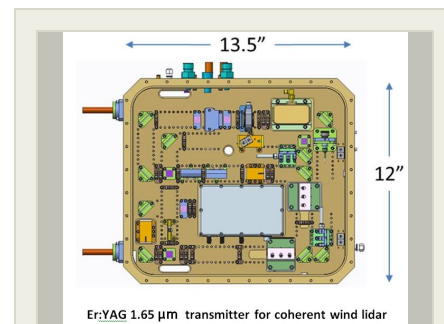
The key NASA applications include the following, all of which have been identified as mission and technology development areas in the 2018 Earth Science Decadal Survey.

1. Coherent detection 3D wind measurement systems. The Er:YAG oscillator could provide a higher efficiency, more robust, and lighter weight approach to the required laser transmitter.

2. Water vapor and methane Differential Absorption Lidar systems.

There is a significant commercial interest in the high-efficiency, compact laser being proposed. The applications include the following:

1. As an upgrade to some of the commercial wind lidar systems used for wind farm and other types of commercial wind measurements. The higher average power of the system we will develop could be used to extend the range of the existing systems.



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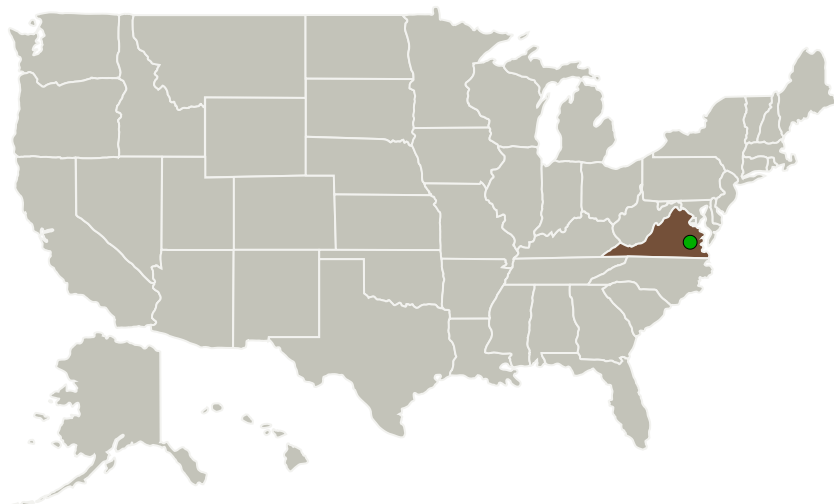
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2. As the transmitter needed for wind lidar used by DoD for precision air drop missions.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Fibertek, Inc.	Lead Organization	Industry	Herndon, Virginia
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

Virginia

Project Transitions

▶ **July 2018:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Fibertek, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

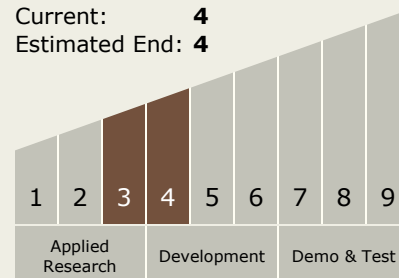
Carlos Torrez

Principal Investigator:

Patrick M Burns

Technology Maturity (TRL)

Start: **3**
 Current: **4**
 Estimated End: **4**



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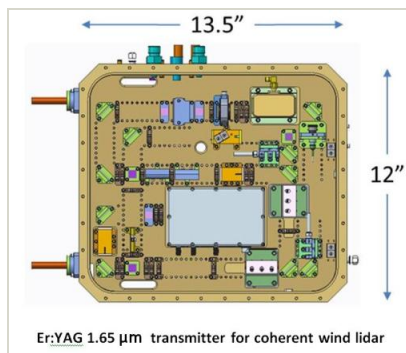


✓ **February 2019:** Closed out

Closeout Documentation:

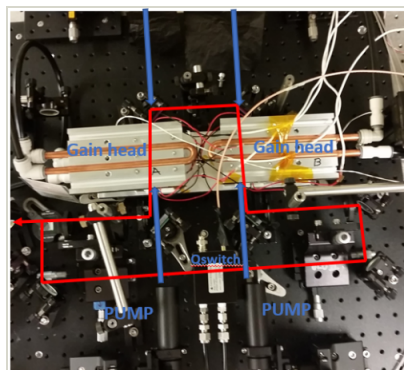
- Final Summary Chart(<https://techport.nasa.gov/file/140869>)

Images



Briefing Chart Image

1.65um Pulsed Laser for Space Based Winds, Phase I
(<https://techport.nasa.gov/image/133701>)



Final Summary Chart Image

1.65um Pulsed Laser for Space Based Winds, Phase I
(<https://techport.nasa.gov/image/128082>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.5 Lasers

Target Destination

Earth